

REMARKS/ARGUMENTS

Claims 1 and 5-7 stand rejected under 35 USC 102(e) as being anticipated by Shields et al (USPG Pub 2003/0218143 A1) (hereinafter “Shields”).

It is noted that independent claim 1, dependent claim 5, independent claim 6 and dependent claim 7 all recite a laser device or lasing method wherein there is directly formed, without going through an intermediary of exciton state, a biexciton state in at least one of the one or more semiconductor quantum dots by the two-photon resonant excitation. This novel recitation in the laser device or lasing method recited in the claims 1 and 5-7 as amended herein is not anticipated, disclosed or even suggested by the teachings of Shields.

The Examiner asserts that Shields discloses, in the Abstract and paragraph [0214], the technique of forming a biexciton state in the semiconductor quantum dot by the two-photon resonant excitation.

However, in paragraph [0214] of Shields, it is merely disclosed that two entangled photons are emitted from a semiconductor quantum dot by exciting the semiconductor quantum dot by the use of a pulsed laser with a predetermined bias. That is, the technique of exciting the semiconductor quantum dot by the two-photon resonant excitation is not disclosed at all, unlike the present invention (please note that the wording “in the mission of” in the paragraph [0214] of Shields should read as “in the emission of”).

As mentioned above, Shields relates to a photon source which is capable of emitting entangled photons, and, unlike the present invention, the technique of exciting the semiconductor quantum dot by the two-photon resonant excitation is not disclosed in Shields.

Therefore, present invention has the characteristic feature that the semiconductor quantum dot is excited by the two-photon resonant excitation, which feature is not disclosed in

Shields. Accordingly, it is clear that the present invention is different from the photon source for emitting entangled photons disclosed in Shields.

Furthermore, Shields fails to disclose the feature of directly forming, without going through an intermediary of exciton state, a biexciton state in at least one of the one or more semiconductor quantum dots by the two-photon resonant excitation, as recited in all of the claims as amended herein.

For the above mentioned reasons, it is submitted that the rejection under 102(e) should be withdrawn.

Claims 1-4, 6 and 7 stand rejected under 35 USC 103(a) as being unpatentable over the previously cited Masumoto' 1993 reference in view of the previously cited Masumoto' 1978 reference. For the reasons set forth hereinafter, it is submitted that the novel recitations in the claims, as amended herein, are not disclosed or rendered obvious by the teachings of the cited references.

The Examiner asserts that the arguments submitted in the Amendment filed on April 26, 2011 are not acceptable because the feature of the present invention, namely, "the biexcitons are directly generated in the quantum dots by the two-photon resonant excitation, without the intermediary of the exciton state" is not recited in the claims.

In view of this, the independent claims 1 and 6 are amended herein so that each of the claims clearly recites the feature of "directly forming, without an intermediary of exciton state, a biexciton state in at least one of the semiconductor quantum dots by two-photon resonant excitation."

By these amendments, it is clear that the characteristic feature of the present invention, namely, "the biexcitons are directly generated in the quantum dots by the two-photon resonant

excitation, without the intermediary of the exciton state" is recited in the amended claims 1 and 6. It is submitted, therefore, that the significant difference between (i) the present invention and (ii) Masumoto' 1978 and Masumoto' 1993 is clarified in the claims, as amended herein.

In the present invention, the semiconductor quantum dot is excited by the two-photon resonant excitation, and it is therefore possible to provide the laser device which utilizes an efficient light emitting phenomenon (see paragraphs [0018], [0107], etc. of the specification of the subject application).

Specifically, the biexcitons are directly generated in the quantum dots by the two-photon resonant excitation, without the intermediary of the exciton state, and this allows easy formation of completely inverted population between the biexciton and exciton states (see paragraphs [0020], [0049], [0109], etc. of the specification of the subject application). This makes it possible to cause superradiance, which is a special light emitting phenomenon. Consequently, light emitting efficiency can be drastically improved.

Such superradiance can never be caused by the configurations disclosed in Masumoto '1978 and Masumoto' 1993. As mentioned in the Amendment filed on April 26, 2011, even a person skilled in the art could not have naturally expected this special feature based on the teachings of Masumoto' 1978 and Masumoto '1993.

Therefore, the laser device and lasing method recited in the amended claims 1 and 6 are not obvious over Masumoto' 1978 and Masumoto' 1993.

Further, we believe that (i) claims 2 through 5, which depend from the amended claim 1, and (ii) claims 7 through 9, which depend from the amended claim 6, also are allowable over the teachings of the Masumoto references.

For the reasons mentioned above, it is submitted that the rejection of claims 1-4, 6 and 7 under §103(a) should be withdrawn.

Claim 5 stands rejected under 35 USC 103(a) as being unpatentable over Masumoto '1993 and Masumoto' 1978 as applied to claim 1, and further in view of the previously cited Ledentsov reference. Since claim 5 depends from claim 1, as amended herein, it is submitted that claim 5 is allowable over the teachings of the Masumoto references for the reasons set forth herein with respect to the rejection of claim 1. The secondary reference to Ledentsov was cited by the Examiner for its limited teaching of a lasing material with InGaAs-GaAs quantum clusters comprising semiconductor quantum dot made of InAs, and base material made of GaAs. Other than this limited disclosure, Ledentsov fails to supply the deficiencies of the Masumoto references with respect to the novel recitations in claim 1 and dependent claim 5.

Claims 8 and 9 stand rejected under 35 USC 103(a) as being unpatentable over Masumoto' 1978. Since claims 8 and 9 depend from claim 7 which in turn depends from claim 6 as amended herein, it is submitted that claims 8 and 9 are allowable over the teachings of Masumoto' 1978 for the reasons submitted herein with respect to the rejection of claim 6.

In view of the above amendments and remarks, it is submitted that all of the claims as amended herein are allowable to Applicants, and formal allowance thereof is earnestly solicited.

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: Frank P. Presta
Frank P. Presta
Reg. No. 19,828

FPP:ils
901 North Glebe Road, 11th Floor
Arlington, VA 22203-1808
Telephone: (703) 816-4000
Facsimile: (703) 816-4100